

WHAT IS CLAIMED IS:

- 1 1. A fuel properties estimating apparatus for an internal
2 combustion engine, the fuel properties estimating
3 apparatus comprising:
4 a controller to determine an estimated component
5 concentration of a component in a fuel for the engine in
6 accordance with an actual air fuel ratio of the engine, the
7 controller being configured to perform a plurality of
8 estimating operations to determine the estimated
9 component concentration at predetermined timings after an
10 engine start of the engine.

- 1 2. The fuel properties estimating apparatus as claimed
2 in Claim 1, wherein the controller is configured to perform
3 first and second estimating operations to determine the
4 estimated component concentration in accordance with the
5 actual air fuel ratio, respectively, at first and second
6 estimating timings after the engine start;
7 the first estimating timing being a timing so
8 determined that the first estimating operation is performed
9 when fuel supplied to the engine is almost switched from
10 fuel remaining in a fuel line from a fuel tank to the engine
11 at the time of the engine start, to fuel existing in the fuel
12 tank at the time of the engine start; and
13 the second estimating timing being a timing so
14 determined that the second estimating operation is
15 performed when disturbance to an air fuel ratio control
16 based on the actual air fuel ratio is settled down.

1 3. The fuel properties estimating apparatus as claimed
2 in Claim 2, wherein the controller is configured to perform
3 the first estimating operation when a fuel injection
4 accumulated quantity after the engine start becomes equal
5 to a predetermined value which is so determined that the
6 first estimating operation is performed when fuel supplied
7 to the engine is switched by a predetermined percentage
8 from the fuel remaining in the fuel line at the time of the
9 engine start, to the fuel existing in the fuel tank at the
10 time of the engine start.

1 4. The fuel properties estimating apparatus as claimed
2 in Claim 3, wherein the controller is configured to perform
3 the second estimating operation at the expiration of a
4 predetermined time interval after the first estimating
5 operation.

1 5. The fuel properties estimating apparatus as claimed
2 in Claim 1, wherein the controller is configured to calculate
3 a fuel supply accumulated quantity after the engine start,
4 and to determine a first estimating timing of a first
5 estimating operation to determine the estimated
6 component concentration in accordance with the fuel supply
7 accumulated quantity after the engine start.

1 6. The information system as claimed in Claim 5,
2 wherein the controller is configured to perform a second
3 estimating operation to determine the estimated
4 component concentration at the expiration of a

5 predetermined time interval after the first estimating
6 operation.

1 7. The fuel properties estimating apparatus as claimed
2 in Claim 6, wherein the predetermined time interval is
3 equal to or longer than 15 minutes, and equal to or shorter
4 than 30 minutes.

1 8. The fuel properties estimating apparatus as claimed
2 in Claim 5, wherein the controller is configured to compare
3 the fuel supply accumulated quantity with a predetermined
4 value corresponding to a predetermined percentage of fuel
5 remaining in a fuel pipe from a fuel tank to the engine; and
6 to perform the first estimating operation when the fuel
7 supply accumulated quantity becomes equal to the
8 predetermined value.

1 9. The fuel properties estimating apparatus as claimed
2 in Claim 8, wherein the controller is configured to measure
3 an elapsed time after the first estimating operation, and to
4 perform a second estimating operation when the elapsed
5 time after the first estimating operation becomes equal to a
6 predetermined time length.

1 10. The fuel properties estimating apparatus as claimed
2 in Claim 8, wherein the controller is configured to compare
3 the fuel supply accumulated quantity with a second
4 predetermined value, and to perform a second estimating
5 operation after the first estimating operation when the fuel

6 supply accumulated quantity become equal to the second
7 predetermined value.

1 11. The fuel properties estimating apparatus as claimed
2 in Claim 1, wherein the component is alcohol, and the
3 estimated component concentration is an estimated alcohol
4 concentration in the fuel for the engine.

1 12. A fuel properties estimating process for an internal
2 combustion engine, the fuel properties estimating process
3 comprising:

4 performing a first estimating operation at a first
5 estimating timing after an engine start of the engine, to
6 determine an estimated component concentration of a
7 component in a fuel for the engine in accordance with an
8 actual air fuel ratio of the engine; and

9 performing a second estimating operation at a
10 second estimating timing after the first estimating
11 operation, to determine the estimated component
12 concentration in accordance with the actual air fuel ratio of
13 the engine.

1 13. The fuel properties estimating process as claimed in
2 Claim 12, wherein the fuel properties estimating process
3 further comprises:

4 calculating a fuel supply accumulated quantity after
5 the engine start; and

6 determining the first estimating timing by comparing
7 the fuel supply accumulated quantity with a predetermined
8 value.

1 14. A fuel properties estimating apparatus for an internal
2 combustion engine, the fuel properties estimating process
3 comprising:

4 means for determining a first estimating timing after
5 an engine start of the engine;

6 means for performing a first estimating operation at
7 the first estimating timing, to determine an estimated
8 component concentration of a component in a fuel for the
9 engine in accordance with an actual air fuel ratio of the
10 engine;

11 means for determining a second estimating timing
12 after the first estimating timing; and

13 means for performing a second estimating operation
14 at the second estimating timing after the first estimating
15 operation, to determine the estimated component
16 concentration in accordance with the actual air fuel ratio of
17 the engine.